



**ROYAL ACADEMY OF
MEDICINE IN IRELAND**

SECTION OF BIOMEDICAL SCIENCES

Annual Meeting 2015

**Including Donegan Medal and
Barcroft Medal Competitions
&
Conway Review Lecture**

18th June 2015

Royal College of Surgeons in Ireland

PROGRAMME & ABSTRACTS

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ROYAL ACADEMY OF MEDICINE IN IRELAND

Section of Biomedical Sciences Annual Meeting
18th June 2015
Royal College of Surgeons in Ireland
Albert Lecture Theatre

Section President: Professor Veronica Campbell, TCD
Section Secretary: Professor Ken O'Halloran, UCC
Local Organisers: Professor Aidan Bradford & Dr. Steve Kerrigan, RCSI

ON-SITE REGISTRATION:	08.15-
Welcome	08.55-09:00
Donegan Communications: D1-D7 Chair: Prof. Ken O'Halloran, UCC	09.00-10.45
Poster Session <i>Coffee/Tea will be served.</i>	10.45-11.30
Donegan Communications: D8-D13 Chair: Prof. Ken O'Halloran, UCC	11.30-13.00
LUNCH <i>(Council Meeting RAMI Section of Biomedical Science; poster viewing)</i>	13.00-14.15
Oral Communications: C1-C5 Chair: Prof. Aine Kelly, TCD	14.15-15.30
Poster Session <i>Coffee/Tea will be served.</i>	15.30-16.30
Barcroft Communications: B1-B3 Chair: Prof. James Jones, UCD	16.30-17.30
Conway Review Lecture Prof. Madeleine M. Lowery University College Dublin <i>Engineering rhythms of the brain: Exploring deep brain stimulation</i> Chair: Prof. Veronica Campbell, TCD	17.30
Drinks Reception & Conference Dinner	18.30

REGISTRATION	08.15
OPENING ADDRESS	08.55

Donegan Medal	09.00-10.30
Communications D1-D7	

D1 09.00

GoSlo-SR5-130 AS A BRONCHODILATOR IN RABBIT AIRWAY

V. Bihun, E. Bradley, G. P. Sergeant, M.A. Hollywood, N. G. McHale, K.D. Thornbury

Smooth Muscle Research Centre, Dundalk Institute of Technology, Dundalk, Ireland.

D2 09.15

FUNCTIONAL GENOMIC SCREENING IDENTIFIES USP11 AS A NOVEL THERAPEUTIC TARGET IN BREAST CANCER

L. Dwane¹, A.E. O'Connor¹, L. Mulrane¹, A.M. Dirac², K. Jirstrom³, J.P. Crown⁴, R. Bernards², W.M. Gallagher¹, D.P. O'Connor¹

¹Cancer Biology and Therapeutics Laboratory, UCD School of Biomolecular and Biomedical Science, UCD Conway Institute, University College Dublin, Ireland; ²Division of Molecular Carcinogenesis, Netherlands Cancer Institute, Amsterdam, The Netherlands; ³Department of Laboratory Medicine, Malmö University Hospital, Lund University, Malmö, Sweden; ⁴St Vincent's University Hospital, Dublin, Ireland.

D3 9.30

NOD-LIKE RECEPTOR EXPRESSION IN INTESTINAL EPITHELIAL AND MONOCYTIC CELL LINES CAN BE ALTERED BY DNA METHYLATION

C.L. Feerick, D.P. McKernan,

Department of Pharmacology and Therapeutics, College of Medicine, Nursing and Health Sciences, NUIG, Galway.

D4 09.45

EFFECTS OF BRL37344 ON CARBACHOL-INDUCED INTRACELLULAR Ca²⁺ TRANSIENTS IN FRESHLY ISOLATED MYOCYTES FROM MOUSE DETRUSOR

C.S. Griffin, N.G. McHale, K.D. Thornbury, M.A. Hollywood, G.P. Sergeant

Smooth Muscle Research Centre, Dundalk Institute of Technology, Dundalk, Ireland.

D5 10.00

EFFECT OF THE NOVEL BK_{Ca} CHANNEL OPENER, GoSlo-SR5-130, ON BK_{Ca} CURRENTS AND CONTRACTILITY OF RABBIT CORPUS CAVERNOSUM

K. Hannigan, R.J. Large, G.P. Sergeant, M.A. Hollywood, N.G. McHale, K.D. Thornbury.

Smooth Muscle Research Centre, Dundalk Institute of Technology, Dundalk, Ireland.

D6 10.15

NOVEL ROLES FOR DIETARY NITRATE IN MULTIPLE CARDIORESPIRATORY DISORDERS

C.P. Kerley^{1,2}, E. Dolan¹, V. Reddy¹, J. O'Neill¹, J.L. Faul¹, L.J. Cormican¹

¹Connolly Hospital, Dublin; ²UCD School of Medicine and Medical Science, University College Dublin, Dublin, Ireland.

D7 10.30

ENDOTHELIAL CELL DYSREGULATION IN SEPSIS IS MEDIATED BY STAPHYLOCOCCUS AUREUS MAJOR SURFACE PROTEIN, CifA

C.J. McDonnell¹, E. Bojenov¹, A. McLoughlin², P.M. Cummins², S.W. Kerrigan¹

¹School of Pharmacy, Molecular and Cellular Therapeutics, Royal College of Surgeons in Ireland; ²School of Biotechnology, Dublin City University, Dublin.

Poster Viewing 10.45-11.30

Authors to attend. Tea/Coffee will be served.

Donegan Medal 11.30-13.00

Communications D8-D13

D8 11.30

FXR STIMULATES miR-29a-3p EXPRESSION IN COLONIC EPITHELIAL CELLS: IMPLICATIONS FOR THERAPY OF INFLAMMATORY BOWEL DISEASE

A. O'Dwyer¹, C. Greene², S. Keely¹

Departments of 1Molecular Medicine and 2Medicine, Royal College of Surgeons in Ireland.

D9 11.45

RESPIRATORY MUSCLE REMODELLING FOLLOWING ACUTE SUSTAINED HYPOXIC STRESS IN THE MOUSE

A.J. O'Leary, K.D. O'Halloran

Department of Physiology, School of Medicine, University College Cork, Cork, Ireland.

D10 12.00

THE RACARDIUM: AN IMPLANTABLE DEVICE TO ALLOW REPLENISHABLE TARGETED CELL AND SMALL MOLECULE DELIVERY TO THE HEART

H.S. O'Neill^{1,2}, E.T. Roche³, W.White³, M.Horvath³, S.Song³, F. McGovern³, F.A. Pigulla⁴, D.J. Mooney³, C. J. Walsh³, G.P. Duffy^{1,2}.

¹Tissue Engineering Research Group, Department of Anatomy, RCSI, Dublin, Ireland; ²Advanced Materials and Bioengineering Research (AMBER) Centre, RCSI & TCD, Dublin, Ireland; ³Wyss Institute for Biologically Inspired Engineering, Harvard University, Boston, MA, USA, and ⁴Department of Cardiac Surgery, Boston Children's Hospital, Boston, MA, USA.

D11 12.15

FATTY ACID MANIPULATION OF OBESITY – CONSEQUENCES FOR HIGH-DENSITY LIPOPROTEIN COMPOSITION AND MACROPHAGE-TO-FECES REVERSE CHOLESTEROL TRANSPORT IN A MOUSE MODEL OF METABOLIC SYNDROME

M. O'Reilly, ¹E. Dillon, ¹O. Finucane, ¹A. Murphy, ¹C. Lyons, ^{2,3}M.P. Reilly, ¹H.M. Roche, ^{1,4}F.C. McGillicuddy

¹Nutrigenomics Research Group, UCD Conway Institute, School of Public Health & Population Science, University College Dublin, Dublin, Ireland; ²Cardiovascular Institute and ³Institute for Translational Medicine and Therapeutics, University of Pennsylvania School of Medicine, Philadelphia, PA, USA; ⁴Diabetes Complications Research Centre, UCD Conway Institute, School of Medicine and Medical Science, University College Dublin, Dublin, Ireland.

D12 12.30

NUMERICAL EXAMINATION OF SWELLABLE MICRONEEDLES

D.T. Tobin, E.D. O'Cearbhaill, A. Ní Annaidh

School of Mechanical and Materials Engineering, College of Engineering and Architecture, University College Dublin, Dublin, Ireland.

D13 12.45

EPIGENETIC MODULATORS FOR THE TREATMENT OF INVASIVE LOBULAR CARCINOMA BREAST CANCER

L. Walsh, T. Ní Chonghaile, W.M. Gallagher, D.P. O'Connor.

UCD School of Biomolecular and Biomedical Science, UCD Conway Institute, University College Dublin, Dublin, Ireland.

LUNCH**13.00-14.15****Poster Viewing****COUNCIL MEETING****13.15-14.00*****RAMI Biomedical Sciences Council Members only***

Oral Communications	14.15-15.30
Communications C1-C5	

C1 14.15

MUTATION OF A RESIDUE IN THE S4S5 LINKER OF THE BK CHANNEL ALTERS THE EFFECTS OF THE NOVEL BK CHANNEL OPENER, GoSlo-SR-5-6

A. Kshatri, T. I. Webb, R.J. Large, S. Roy, G.P. Sergeant, N.G. McHale, K.D. Thornbury and M.A. Hollywood.

Smooth Muscle Research Centre, Dundalk Institute of Technology, Dundalk, Ireland.

C2 14.30

SUPPRESSION OF HYPOXIA-INDUCED HIF STABILISATION BY HYPERCAPNIA

A. Selfridge¹, C. Scholz², P. Sporn³, J. Sznajder³, E. Campbell⁴, S. Colgan⁴, E. Cummins¹, C. Taylor¹

¹University College Dublin, Ireland; ²University of Zurich, Switzerland; ³Northwestern University, Chicago, USA; and ⁴University of Colorado Denver, USA.

C3 14.45

ADVANCED DIFFUSION IMAGING CAPTURE EARLY WHITE MATTER BRAIN CHANGES IN ADOLESCENTS EXPERIENCING PSYCHOTIC SYMPTOMS.

E. O'Hanlon^{1,5}, A. Leemans², I. Kelleher¹, M. Clarke^{1,3}, F. Amico¹, T. Frodl⁴, M. Cannon³

¹Dept. of Psychiatry, Royal College of Surgeons in Ireland, Dublin 2, Ireland; ²Image Sciences Institute, University Medical Center Utrecht, Utrecht, the Netherlands; ³Department of Psychology, Royal College of Surgeons in Ireland; ⁴Department of Psychiatry, Trinity College Dublin, Ireland; ⁵Trinity College Institute of Neuroscience, Ireland.

C4 15.00

IDENTIFICATION OF A BIOMARKER FOR PARKINSON'S DISEASE THROUGH NONLINEAR ANALYSIS OF SURFACE ELECTROMYOGRAPHY

M. Flood^{1,2}, M.M. Lowery^{1,2}

¹UCD School of Electrical, Electronic & Communications Engineering; ²SFI Insight Centre For Data Analytics, University College Dublin, Dublin, Ireland.

C5 15.15

INCREASE IN INTRA-MUSCULAR COHERENCE AFTER FATIGUE IN THE FIRST DORSAL INTEROSSEOUS

L.M. McManus, X. Hu, W.Z. Rymer, N.L. Suresh, M.M. Lowery

¹University College Dublin, Dublin, Ireland; ²Rehabilitation Institute of Chicago, Illinois, USA; ³Northwestern University, Chicago, Illinois, USA.

Poster Viewing 15.30-16.30
Authors to attend. Tea/Coffee will be served.

Barcroft Medal Competition 16.30-17.30
Communications B1-B3

B1 16.30

TAILORING APPROACHES FOR GLOBAL EPIGENOME AND MUTATIONAL ANALYSIS FROM A FFPE SAMPLE PERSPECTIVE

S. Das¹, B. Moran¹, D. Smeets², R. Klinger¹, B. Fender³, G. Peutman², A. Byrne⁴, D. Lambrechts², W. Gallagher¹, D. O'Connor¹

¹Cancer Biology & Therapeutics Laboratory, Conway Institute, University College Dublin, Ireland; ²Department of Translational Genetics, VIB, K.U., Leuven, Belgium; ³Oncomark Ltd., Nova UCD, Ireland; ⁴RCSI, Ireland.

B2 16.50

TARGETING MYCN VIA ITS PROTEIN-PROTEIN INTERACTIONS IN NEUROBLASTOMA

M. Halasz¹, T. Santra¹, K. Killick¹, D. Duffy¹, K. Iljin², T. Look³, F. Westermann⁴, B. Kholodenko^{1,5,6}, W. Kolch^{1,5,6}

¹Systems Biology Ireland, University College Dublin, Belfield, Dublin 4, Ireland; ²VTT Technical Research Centre of Finland, Tietotie 2, Espoo, FI-02044 VTT, Finland; ³Department of Pediatric Oncology, Dana-Farber Cancer Institute, Harvard Medical School, Boston, Massachusetts, USA; ⁴Department of Neuroblastoma Genomics, German Cancer Research Center (DKFZ), 69120 Heidelberg, Germany; ⁵Conway Institute of Biomolecular & Biomedical Research, University College Dublin, Belfield, Dublin 4, Ireland; ⁶School of Medicine and Medical Science, University College Dublin, Belfield, Dublin 4, Ireland.

B3 17.10

CARDIAC METABOLIC PATHWAY REMODELLING IN RESPONSE TO SUNITINIB MALATE: POTENTIAL ROLE FOR POSITRON EMISSION TOMOGRAPHY IN THE CARDIO-ONCOLOGY SETTING

A.C. O'Farrell¹, R. Evans¹, J.M.U. Silvola², I.S. Miller¹, E. Conroy³, S. Hector^{1,4}, M. Cary⁵, D. Murray^{1,6}, M.A. Jarzabek^{1,4}, A. Maratha⁶, M. Alamanou⁶, G. Mallya Udupi⁶, L. Shiels¹, C. Pallaud⁴, A. Saraste^{2,7}, H. Liljenbäck², M. Jauhiainen⁸, V. Oikonen², A. Ducret⁴, P. Cutler⁴, F.M. McAuliffe⁹, J.A. Rousseau¹⁰, R. Lecomte¹⁰, S. Gascon¹⁰, B. Ky¹¹, T. Force¹², J. Knuuti², W. Gallagher^{3,6}, A. Roivainen², A.T. Byrne¹

¹Royal College of Surgeons in Ireland, Dublin, Ireland; ²Turku PET Centre, University of Turku, Turku University Hospital and Åbo Akademi University, Turku, Finland; ³University College Dublin, Dublin, Ireland; ⁴Roche Innovation Center Basel, F Hoffman La Roche, Basel, Switzerland; ⁵Pathology Experts GmbH, Basel, Switzerland; ⁶Oncomark Ltd, Dublin, Ireland; ⁷Heart Center, Turku University Hospital and University of Turku, Turku, Finland; ⁸Public

Health Genomics Unit, National Institute for Health and Welfare, Helsinki, Finland; ⁹UCD Obstetrics and Gynaecology, School of Medicine and Medical Science, University College Dublin, National Maternity Hospital, Dublin, Ireland; ¹⁰Université de Sherbrooke, Québec, Canada; ¹¹Department of Medicine, Hospital of the University of Pennsylvania, Philadelphia, PA, USA; ¹²Vanderbilt University School of Medicine, Nashville, USA.

Conway Review Lecture 17.30

Prof. Madeleine Lowery, UCD

Engineering rhythms of the brain: Exploring deep brain stimulation

DRINKS RECEPTION 18.30

CONFERENCE DINNER 19.00

Posters

P1-P22

P1

DIFFERENTIAL EXPRESSION OF MICRORNAs FOLLOWING STAPHYLOCOCCUS AUREUS INFECTION OF HUMAN ENDOTHELIAL CELLS

R. Watkin¹, C.J. McDonnell¹, I.M. Bray², R.L. Stallings², S.W. Kerrigan¹

¹Cardiovascular Infection Research Group and ²Cancer Genetics Research Group, Royal College of Surgeons in Ireland, Dublin 2, Ireland.

P2

DEFINING THE EARLY EVENTS IN NEONATAL SEPSIS: THE ROLE OF THE ENDOTHELIUM AND PLATELETS IN DISEASE PROGRESSION

L. Hughes¹, J. Silva Santos de Oliveira², C.J. McDonnell¹, M. Meehan³, P. Nagao², S.W. Kerrigan¹

¹Cardiovascular Infection Group, RCSI, Dublin 2, Ireland; ²State University of Rio de Janeiro, Brazil; ³Temple Street Children's University Hospital, Dublin 1, Ireland.

P3

INVESTIGATING THE ROLE OF STAPHYLOCOCCUS AUREUS PROTEIN A IN A 3D MODEL SYSTEM OF OSTEOMYELITIS

N. Kavanagh^{1,2}, A. Widaa^{1,2}, F.J. O'Brien², S.W. Kerrigan¹

¹Host Infection Group and ²Tissue Engineering Research Group, RCSI, Dublin 2, Ireland.

P4

DEVELOPMENT OF AN IN VITRO MODEL OF BREAST TUMOUR MICROCALCIFICATION

S. O'Grady, M.P. Morgan

Molecular and Cellular Therapeutics, Royal College of Surgeons Ireland, Dublin

P5

CONTRIBUTION OF DIFFERENT BK · 1 RESIDUES TO THE EFFECT OF THE NOVEL BK CHANNEL OPENER GoSlo-SR-5-130.

S. Dudem, A. Kshatri, S. Roy, N.G. McHale, G.P. Sergeant, K.D. Thornbury, M.A. Hollywood

Smooth Muscle Research Centre, Dundalk Institute of Technology, Dundalk, Ireland.

P6

EFFECT OF THE NOVEL CHLORIDE CHANNEL BLOCKER GoSlo-SR5-110 ON RABBIT URETHRA ICC AND TMEM16A CURRENTS EXPRESSED IN HUMAN EMBRYO KIDNEY CELLS

S.J. Fedigan, A. Kshatri, T.I. Webb, S. Roy, K.D. Thornbury, M.A. Hollywood, N.G. McHale, G.P. Sergeant

Smooth Muscle Research Centre, Dundalk Institute of Technology, Dundalk, Ireland.

P7

THE EFFECTS OF CONCANAVALIN A ON THE LIVER MORPHOLOGY AND INTESTINAL PERMEABILITY IN MICE

H.M. Ngatiman¹, M. Marlini¹, B. Mallard¹, P. Dockery^{2,3}, A.M. Wheatley¹

¹Disciplines of Physiology and ²Anatomy, College of Medicine; ³Centre of Microscopy and Imaging, NUI Galway, Galway, Ireland.

P8

GLP-1 EVOKES CALCIUM RESPONSES IN SUBMUCOSAL NEURONS, VIA ACTIVATION OF THE JAK/STAT AND PI3 KINASE PATHWAYS IN SPRAGUE DAWLEY COLONIC TISSUE

R. O'Brien, M.M. Buckley, D. O'Malley

Department of Physiology, University College Cork, Cork, Ireland.

P9

IMMUNE AND STRESS FACTORS ALTER GUT NERVE ACTIVITY

M.M. Buckley, D. O'Malley

Department of Physiology, University College Cork, Cork, Ireland.

P10

OXIDATIVE ENZYME ACTIVITY IN RESPIRATORY AND NON-RESPIRATORY MUSCLE OF HYPOXIC MICE AND HUMAN RESPIRATORY PATIENTS

K.M. O'Connor¹, P. Lewis¹, A.J. O'Leary¹, T. Ni Hici², N. Mayooraan², J. Hinchion², K.D. O'Halloran¹

¹Department of Physiology, School of Medicine, University College Cork, Cork, Ireland; and ²Cork University Hospital, Cork, Ireland.

P11THE EFFECTS OF UPPER AIRWAY OCCLUSION ON STERNOHYOID MUSCLE PO₂ IN THE ANAESTHETISED RAT

E. Casey, K.D. O'Halloran, D. Edge

Department of Physiology, School of Medicine, University College Cork, Cork, Ireland.

P12

INVESTIGATION OF ALTERATIONS IN CARDIAC MUSCLE EXCITATION-CONTRACTION COUPLING PROTEINS IN A RODENT MODEL OF CHRONIC INTERMITTENT HYPOXIA

R. Carey¹, F.A. Lai², E.F. Lucking³, K.D. O'Halloran¹, J.J. Mackrill¹

¹Department of Physiology, School of Medicine, University College Cork, Cork, Ireland; ²Wales Heart Research Institute, Institute of Molecular and Experimental Medicine, Cardiff University School of Medicine, Cardiff, UK; and ³UCD School of Medicine and Medical Science, University College Dublin, Dublin, Ireland.

P13THE SUPEROXIDE SCAVENGER TEMPOL DOES NOT IMPROVE DIAPHRAGM MUSCLE WEAKNESS IN THE *MDX* MOUSE MODEL OF DUCHENNE MUSCULAR DYSTROPHY

I. Ali, D. Burns, P. Lewis, D. O'Malley, K.D. O'Halloran

Department of Physiology, School of Medicine, University College Cork, Cork, Ireland.

P14

ACUTE AND LONG-TERM EFFECTS OF REMOTE ISCHAEMATIC CONDITIONING ON AUTONOMIC CONTROL OF THE CARDIOVASCULAR SYSTEM

L.-M. Hart, C. Johnson

Centre for Biomedical Sciences Education, School of Medicine, Dentistry and Biomedical Sciences, Queen's University of Belfast, Belfast, UK.

P15

HIGH INTENSITY INTERVAL TRAINING (HIIT) AND CONTROL OF THE AUTONOMIC NERVOUS SYSTEM

N. Moreland, C. Johnson

Centre for Biomedical Sciences Education, School of Medicine, Dentistry and Biomedical Sciences, Queen's University of Belfast, Belfast, UK.

P16

EFFECT OF AEROBIC EXERCISE ON COGNITION AND QUALITY OF LIFE IN MULTIPLE SCLEROSIS

A. Barry¹, O. Cronin², A.P. Allen³, G. Clarke³, O. O'Toole⁴, S-M. Yap⁴, B. Sweeney⁵, A.M. Ryan⁵, K.D. O' Halloran¹, E.J. Downer^{6,7}

¹Department of Physiology, University College Cork, ²Department of Medicine, University College Cork, ³Department of Psychiatry, Alimentary Pharmabiotic Centre, University College Cork, ⁴Mercy University Hospital, Cork, ⁵Department of Neurology, Cork University Hospital, ⁶Department of Anatomy and Neuroscience, University College Cork, ⁷School of Medicine (Physiology), Trinity Biomedical Sciences Institute, Trinity College Dublin.

P17

AN INVESTIGATION INTO THE ROLE OF GPR55 IN REGULATING NEUROINFLAMMATION AND NEURODEGENERATION

O. Haugh¹, A.L. O'Brien¹, A.J. Irving², V.A. Campbell¹.

¹School of Medicine and Department of Physiology, Trinity College Dublin, the University of Dublin, Ireland and ²School of Biomolecular and Biomedical Science, University College Dublin, Ireland.

P18

INVESTIGATING THE INVOLVEMENT OF THE CYCLIC ADP RIBOSE SIGNALLING PATHWAY IN GROUP I METABOTROPIC GLUTAMATE RECEPTOR-MEDIATED SIGNALLING IN CULTURED MURINE HIPPOCAMPAL NEURONES

A. Kaar, M.G. Rae. Department of Physiology, University College Cork, Cork, Ireland.

P19

THE INVOLVEMENT OF PANX-1 IN AMYLOID-INDUCED NEURODEGENERATION AND THE PROTECTIVE EFFECT OF THE ENDOCANNABINOID SYSTEM

S.G. Fagan, C. Rispin-Dureuil, T. Lyons and V.A. Campbell

Trinity College Institute of Neuroscience, Department of Physiology, Trinity College Dublin, Ireland.

P20

SCHIZOPHRENIA AND SYNAPTIC PLASTICITY: GENE SET ANALYSIS HIGHLIGHTS NEW TARGETS FOR INVESTIGATION

A. Dyer, N. Mortimer, C. Michiels, D. Tropea

Department of Psychiatry, Trinity College Dublin, Dublin, Ireland.

P21

TLR3-INDUCED INFLAMMATORY RESPONSES IN THE RAT HYPOTHALAMUS ARE ATTENUATED FOLLOWING FAAH, BUT NOT MAGL, INHIBITION; AN EFFECT INDEPENDENT OF SEX

L. Flannery^{1,2}, R. Henry^{1,3}, D.M. Kerr^{1,2,3}, D.P. Finn^{2,3}, M. Roche^{1,3}

¹Physiology and ²Pharmacology and Therapeutics, School of Medicine, ³NCBES Centre for Pain Research and Galway Neuroscience Centre, National University of Ireland Galway, Ireland.

P22

BRADYKININ RECEPTOR BLOCKADE RESTORES THE SYMPATHO-INHIBITORY RESPONSE TO VOLUME EXPANSION IN A CISPLATIN INDUCED RENAL FAILURE MODEL

H. Swanton, M. Abdulla, J. Manning, E.J. Johns

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